

Columbia Accident Southwest Research Institute (SwRI) Testing

Objective:

The Columbia Accident Investigation Board, working in concert with NASA and its contractor personnel, will attempt to simulate the most likely possible scenarios for damage caused by external tank foam debris which was observed striking Columbia 81 seconds after its launch on Jan. 16.

Duration:

The testing at Southwest Research Institute (SwRI) in San Antonio, TX, will last four to six weeks. SwRI has worked with NASA in the past to test various thermal protection systems and was selected to perform the Columbia-related testing because of its unique facilities. More information is available in the FAQ from SwRI. The SwRI web site can be viewed at:

<http://www.swri.org/>

Testing Overview:

The tests will involve striking the various orbiter thermal protection materials with insulating foam, called Spray On Foam Insulation (SOFI), that is used on the space shuttle external tank. The tests will involve a variety of sizes and weights of foam to simulate debris impacting the various orbiter thermal protection materials, attempting to include all of the most likely possibilities for the foam debris which struck Columbia 81 seconds after launch on Jan. 16. The materials being tested also will be positioned so that the foam strikes at a range of angles and velocities to include all of the most likely possibilities for what might have occurred on Jan. 16. The range of foam sizes, impact angles and velocities that will strike the various shuttle orbiter thermal protection materials during the testing is planned to simulate all possibilities for the amount of damage caused by the debris that struck Columbia during ascent.

Space Shuttle orbiter thermal protection system materials that will be struck by external tank SOFI foam during the testing will include:

- A main landing gear door with High Temperature Reusable Surface Insulation (HRSI) thermal tiles attached.
- A section of the bottom of an orbiter wing with HRSI tiles attached.
- A wing carrier panel with HRSI tiles attached (the carrier panel is an access panel mounted just below the wing leading edge Reinforced Carbon-Carbon panels -- the panel can be removed to allow access for technicians to reach bolts that hold in place the wing leading edge RCC panels).
- A wing leading edge RCC panel that was removed from the Space Shuttle orbiter Discovery, the orbiter that has flown more flights than any other shuttle vehicle.

Each test run is anticipated to require two to three days to set up, allowing appropriate sensors to be placed on the test samples and the positioning of the samples in the test stand.

Test Equipment, Personnel, Etc.:

A total of six high-speed cameras, filming at 2,000-5,000 frames per second, will capture images of the foam's impact. This will allow engineers to view in slow motion any damage that might occur to better determine how the damage was caused. In addition, a number of standard video cameras (with 30 frames per second) will also be used.

There is a large, technically diverse group of people involved in the testing. They include personnel from the CAIB, the NASA Accident Investigation Team (NAIT), the Johnson Space Center (Engineering and Space and Life Sciences Directorates), the Marshall Space Flight Center, Boeing (Houston, Huntington Beach and KSC), Lockheed Martin (Houston and Michoud), Southwest Research Institute, and USA (Houston and KSC). The testing team consists of instrumentation specialists, test range operators, photographers and impact damage analysts. Before and after each test run, a team will evaluate and analyze any damage to the materials.

SwRI and NASA History:

SwRI's most recent work for NASA in the area of shuttle tile impacts was completed in 1999, with the final report available in its entirety at

http://www.jsc.nasa.gov/news/columbia/orbiter_tile_impact_testing.pdf (37.9 Mb PDF)

That project involved firing small tile pieces, ranging in size from 1 to 3 inches and weighing less than 2 grams, into single pieces of shuttle tile. Before that, SwRI was hired by NASA contractor Rockwell to support another NASA program to fire smaller pieces of a different foam type into single shuttle tiles. That work was completed in 1989.

SwRI has supported the NASA space program since the 1960s by performing theoretical space research and designing and building spaceflight computers and science instruments. Most recently, SwRI was selected to lead the New Horizons mission to Pluto and the Kuiper Belt.

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